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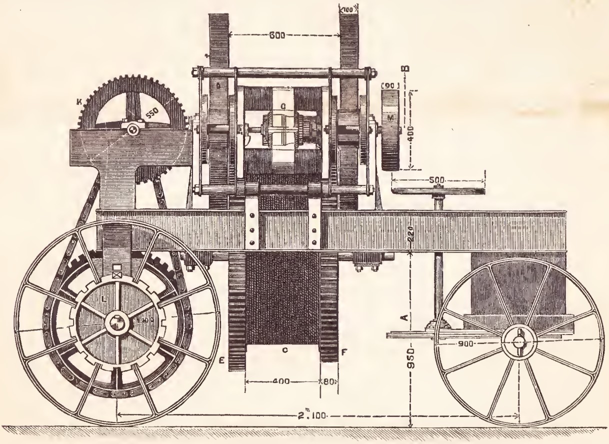
Ploughing by Electricity.

PERHAPS the application of electricity to the performance of heavy farm-work is the last which would suggest itself to the majority of our readers. Yet this has been, according to the *Revue Industrielle*, quite successfully accomplished in France. That journal says that experiments have lately been held at Sermaize, Marne, with a new system of cultivation by mechanical power, with apparatus designed by two engineers, MM. Chrétien and Félix, who, with a view to the more general adoption of mechanical power on farms, devised an arrangement by which motive power in a certain fixed position may be employed to do the work of several adjacent farms through the medium of electricity as an agent of transmission. They have for this purpose adopted the Gramme dynamo-electric machine for the generation of electricity, and similar machines as the electro-dynamic agent for reconversion of the electricity, conveyed to any required distance by cables, into motive power. Power thus transmitted was employed at a beetroot-sugar factory during the whole of last winter, and within the past few weeks it has been thus transmitted to some neighboring fields, which have been ploughed by a balance plough and the windlasses which we illustrate in Figs. 1 and 2. Each of these consists of a carriage of wrought iron, the two side frame pieces being of I section, mounted on four iron wheels. Two Gramme electro-dynamic machines G G are mounted on a hinged frame attached to the side frames. These machines are connected together at their upper parts by means of a simple connecting rod and a pair of India-rubber rings,* which hold the pulleys on the end of the Gramme machine spindles, against the pulleys D D. The small pulleys in the Gramme machines are covered with gutta-percha. The hauling drum C receives the movement of the pulleys D, by means of the pinions E or F, which give the slow or fast speed respectively. Upon the end of the spindle carrying the pulleys D is fixed a bevel pinion gearing with the bevel wheel K, upon the shaft carrying which is a pitch pinion, over which and the wheel L runs a pitch chain, by which the headland movement of the windlass is obtained. The steering of the windlass is effected by the hand wheel, as shown in front. For working, the hind wheels are fixed upon the axle by a set screw, which is loosened for traveling. The rope H is of steel 12mm. diameter, and 250 kils. in length, as used at Lermaize. The electric cables are carried on posts, as for telegraphic purposes. They consist of wires each one millimetre in diameter, giving a total sectional area of about seven square millimetres. In the experiments the windlasses constituted as above were placed at a distance of 200 metres apart, and by means of commutators the electricity was alternately passed through the one and the other pair of machines as the plough crossed and recrossed the field. An engine in the sugar factory already mentioned, and situated 400 metres from the field, gave motion to the dynamo-electric machines which supplied the electricity, about 8 horse power being employed. When in light ground two furrows have been made, but in heavy ground only one, the power transmitted to the plough being but that of three to four horses. The designers will, however, soon have machinery ready which will enable them to use a four-furrow plough.

The Gramme machines at the works were driven at 1,600 revolutions per minute, while those on the windlasses made 800 per minute. The pulleys D made 133 revolutions per minute, and the hauling drums fourteen and twenty-seven under the slow and fast speeds respectively, he corresponding speeds of the plough being 50 and 81 metres per minute. The furrows were 0.275 metre wide—10.8 inch—and 0.20 metres deep—7.87 inches. Making two furrows, about 22 square metres were ploughed per minute. It was found that about 50 per cent. of the work of the fixed engine was realized on the field, and that the efficiency of the electro-dynamic apparatus is from 30 to 60 per cent., according to the distance of transmission.

It is urged that the apparatus will provide in France the means of supplanting much hand labor, which is somewhat scarce, and that by its means many falls of water not now used may be usefully employed for purposes of transmission. This is, so far as we are aware, the first instance of any application of electricity to the performance of farm-work.



SIDE ELEVATION

PLOUGHING BY ELECTRICITY.—FIG. 1. (SEE PAGE 160 FOR FIG. 2.)

*The arrangement of friction wheel I and the spiral spring J was removed after trial, as not giving sufficient rigidity, though the friction was very small.

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The Scientific News is sent to European subscribers at $1.50 per annum, postage paid.

The chief reasons why our patent business has grown up to such importance are that, united to a long experience in the business, we devote very careful attention to the study and preparation of our cases. In addition to this care and study, we do not abandon the interest of our clients after their applications are filed in the Patent Office. We have the advantage of the best service at Washington to look after all the requirements of the Commissioner.

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In our last number we discussed the report of the Commissioners of Rapid Transit, and stated the probability that they had exceeded the expectations of the Mayor in the attempt to locate another rapid transit road to run through the very heart of the city. The Mayor, in his recent communication to the Board of Aldermen, appears not to be satisfied with the work done by his selected commissioners. He says, "it will be doubted whether the determination of the routes is not wanting in definiteness," etc. This is certainly a very mild way of administering rebuke to a commission of his own choosing, who appear to have played furtively into the hands of a few large capitalists and schemers.

There always is, and always must be, a fight by the people against the grasping intentions of corporations.

The almost simultaneous lightning stroke of three children (two in this city killed and one in Hartford injured), who had placed themselves under trees in a shower, gives terrible emphasis to the oft-reiterated assertion of the extreme danger of such a position in a thunder-storm. All people should remember that the risk of a good wetting is nothing to that incurred by close proximity to the trunks of trees, especially those which grow to considerable heights, like pines, hemlocks, etc.

The Fall River Strike.

No sooner have we recorded the peaceful and happy termination of the Western Iron-Workers' strike, than the wires transmit the news of another strike in the Eastern States. Fifteen thousand hands have united in a demand for higher wages in Fall River, and the mills, unless a supply of labor can be obtained from other sources, will be compelled to stop. We regret to say that the condition of our cotton manufacturing interest is not favorable to a compliance with the demand for increase of wages, although it is admitted that the business has much improved of late. The increase demanded by the spinners is small, but it seems to be refused on principle by the mill-owners, as it was dictated by the Trades Union, to whose dictation the manufacturers make obstinate protest. Of course, unless the places of the striking spinners can be supplied, the mills will be as much crippled as if their water-wheels were smashed.

This alternative, moreover, involves the danger of a strike of the weavers, as it is unlikely that equally skillful help can readily be obtained, and the supply of poorer yarn will at once lessen the earnings at the looms. Should this result, the end of the contest may be indefinitely postponed.

Professor Fairfield's Discovery.

In another column will be found an abstract (kindly supplied by the author) of an important paper just transmitted to the Academy of Sciences, France, describing remarkable results obtained through the employment of an improvement in object-glasses for microscopes, which extends the field of microscopical research farther than its most sanguine and ardent devotees have dared to hope.

Prof. Fairfield does not absolutely assert, but his observations leave little room for doubt, that the enormous power thus given to actual vision has rendered it possible to clearly see organic living molecules. He describes the form of what, at present, appears to be the molecule of albumen.

The exact nature of his improvement in object-glasses is withheld, but it rests, as Prof. Fairfield explains, upon certain properties of lenses, practically applied to the structure of object-glasses, by which with perfect definition the magnifying power of microscopes is increased, reckoned by areas, to $40\frac{3}{4}\frac{3}{4}$ times that of lenses constructed according to formulæ in use by the best opticians.

This enormous stride must have the effect to bring the name of Prof. Fairfield prominently before the entire scientific world, as one of the most deserving of those upon whom science delights to bestow its honors.

The discoveries that must result from such an enlargement of present scientific resources it is at present impossible to foresee. Deep into the mysteries of molecular constitution scientists have penetrated already by indirect methods. It now seems that direct observation may supplement the inferences already drawn, and lead to a far clearer conception of the forms of molecules. It is with great pleasure we chronicle this brilliant discovery, following so closely upon other great achievements of this rapid age.

Capt. Eads' Proposed Substitute for a Ship Canal. A Ship Railway.

It appears from reports of surveys and estimates submitted to the Canal Congress in Paris, that the construction of such a means of communication between the two oceans across the American isthmus cannot fall short of $140,000,000. In a letter to the New York *Tribune*, proposing a substitute for such canal, Capt. James B. Eads, well known to the engineering public through the large internal improvements he has projected and carried out, comments upon the project as follows:

"1st. That the amount of capital required is so vast that it will not pay to execute the work with private means alone. 2d. That the amount cannot probably be obtained unless the governments of the several maritime nations directly interested in the work can be induced to contribute liberally in aid of the enterprise. 3d. That the time for consummating the work is so great that the enjoyment of the completed canal must necessarily be reserved to the next generation."

He proposes as a substitute for a canal a ship railway, by which loaded vessels may be raised from the water, transported overland and floated again. The main features of the project are a railway forty feet in width and having eight or ten rails, with elevated termini, hydraulic devices (locks are specified) for raising and lowering the vessels to and from the elevated termini, and a car or cradle for the reception and support of the raised vessel, such car to be made in locomotive sections of say five in number, and altogether comprising one thousand supporting wheels.

The weight thus distributed will be less than that on the ties of ordinary railways when passed over by the driving wheels of locomotives.

Capt. Eads asserts his entire confidence in the practicability of the scheme, and places the cost of construction at about $50,000,000.

Electric Illumination.

Although the practicability of the general introduction of electric illumination is by some still doubted, our faith is strong that in the fullness of time the electric light will be as familiar in every household as gas-lights are now. Our faith is strong, moreover, that this consummation is not very remote. It is true there are yet unsurmounted difficulties; but the end is so desirable, and its pursuit so attractive, that it will command the attention of the best minds and the most brilliant inventive genius till it is reached. The select committee of the British House of Commons, appointed to make inquiry upon the subject of public lighting by electricity, has had before it, among others, Sir William Thompson, Professor of Natural Philosophy in the University of Glasgow, Fellow of St. Peter's College, and lately President of the Royal Society of Edinburgh. Perhaps no man of equal ability and attainments has devoted more attention to the special problem of electric illumination; and probably there is no living *savant* whose opinion would carry greater weight upon this subject.

He deliberately and earnestly stated to the Committee, that he anticipated a great and immediate future for electric lighting, and he believed it would be used before long in every case where a fixed light is required, whether in large or small rooms, and even in lobbies and other parts of private houses.

In reply to the Chairman of the Committee (Dr. Lyon Playfair), who said: "Then, in your opinion, such an extended use of the light is not a mere dream of the *savant*, but is a practical possibility of the future?" Prof. Thompson replied: "Most certainly. The electric light has been in dreamland for sixty years, but it is now coming into the world of reality and is rapidly developing in good hands. There is immense promise in the actual work carried on by practical men in the present day."

He also asserted that the electric arc could be produced of the power of 2,400 candles for 1 horse-power, or even more than 2,400, according to the dimensions or conditions of the arc. In the case of gas, 1 horse-power of energy would produce a power of twelve candles. The result of experiments made at Messrs. Siemens' Works, at Woolwich, and of experiments at the Natural Philosophy Class in the University of Edinburgh, was that allowing the practical estimate of 1 horse-power applied in driving the engine, which had produced 1,200 candles of actual visible electric light, half the gross energy went to produce the electric light, while the other half was lost in heating different parts of the machine and the wires.

He spoke in terms of high praise of the Siemens Regulator, which he had seen on the day previous to his appearance before the Committee. "This regulator gave a steady, pure and quiet light. He blew it out seven times, but it instantly relighted itself. The performance was quite beautiful, and was incomparably better than anything of the kind he had previously seen. It was a water pole regulator—that was to say, it had a copper tube below in which water flowed. The copper tube was substituted for the lower electrical carbon, and it had this advantage—it prevented the upper or positive carbon from becoming cupped as in the ordinary way, by which "cupping" a mushroom growth became encrusted on the top of the lower carbon, and broke off from time to time, while at other times it completely joined the two carbons, compelling the electric arc to seek another outlet, and so causing flickering and hissing. This mushroom growth was entirely done away with by the use of the Siemens water-pole. The upper pole was still carbon, but it did not become cupped, and this, of course, was a great advantage."

He advocates an elevated position of electric lamps for street illumination, and also the doing away with the so-called opal globes, which absorb from 50 to 60 per cent. of the light. For long and crooked passages he suggests the use of mir-

rors for reflecting the light into parts of the space not accessible to direct rays from the light.

The greatest remaining problem connected with this subject is economical subdivision. This is theoretically possible; but, so far, all attempts at subdividing have resulted in notable loss of aggregate illumination.

The hopes excited by Mr. Edison's premature announcements have not yet been publicly realized; if, indeed, they have really been reached in his laboratory, as was stated by his interviewers. We do not believe this part of the problem can be hastily solved by empirical expedients. Profound research and much experiment will doubtless prove necessary; these are not likely to be wanting.

The Alleged Discovery of Signor Rotura.

IN another place, under the title "Scientific Resurrection," we publish an account of artificial suspension of life, and subsequent restoration by means said to have been discovered by one Signor Rotura.

Dr. Richardson, an eminent English physiologist, who has paid much attention to the action of narcotics and anæsthetics, expresses the belief that such suspension and restoration of animation is possible. Indeed, he alleges that he has himself performed it with fishes, frogs and other cold-blooded animals. He doubts, however, the genuineness of the results said to have been obtained by Signor Rotura, of which he speaks as follows:

"If the experiments reported from Brisbane be reliable, it is clear, I think, that what has been done has been effected by the combination of one of the chemical agents above named, or of a similar agent, in combination with cold, the efficiency of which combination we have seen in many of the experimental facts referred to above. The only question that exists as of moment is, not whether a new principle has been developed, but whether, in matter of detail, a new product has been discovered which, better than any of the agents we already possess, destroys and suspends animation. In organic chemistry there are, I doubt not, hundreds of substances which, like mandragora and nitrite of amyl, would suspend the vital process, and it may be that a new experimenter has met with such an agent. It is not incredible, indeed, that the Indian Fakirs possess a vegetable extract or essence which possesses the same power, and by means of which they perform their as yet unexplained feat of prolonging living burial; but I confess, on reading the Australian narrative, there is nothing suggested by it to my mind that might not be produced by agents already known. Making allowance for what is clearly a very enthusiastic description, there is nothing in an experiment related as made on a dog that might not have been produced by the subcutaneous injection of hydrate of chloral; neither is there anything in other experiments that might not follow from the injection of chloral or woorali in a cold atmosphere. At the same time it is not also unreasonable to infer that a new product has been found which surpasses any we possess, and suspends animation for a longer period. My faith is most shaken first by the statement that the agent referred to is a secret, for men of true science know no such word; secondly, that the experimenter has himself to go to America to procure more supplies of his agents; and thirdly, that he requires two agents, one of which is antidotal to the other. I can understand the production of a definite effect from a single; and others as well as myself have made out a great many facts respecting the antagonism of one agent by another. But in our researches on antagonistic physiological substances we require the agencies of absorption and circulation of the antidote, and how, in a body bereft of motion and practically dead, such absorption can take place, I am unable to divine."

Drying Processes, and Patents Relating Thereto. No. 3: Processes Depending Solely Upon Chemical Affinity or Molecular Attraction.

THE chemical affinity of water for many substances is very great. Its chemical compounds (hydrates) are numerous. The slaking of lime is a good illustration of the energy with which many of this class of combinations take place. Quicklime, calcium chloride, caustic potassa and soda are among the most efficient agents for drying wet gases. These substances, when calcined, are separated from a large part or the whole of the water which they absorb in a cold state, and may thus be used over and over for extracting water from air or gases, the particular one selected depending upon the nature and affinities of the gas to be dried. Carbonic acid gas and chlorine gas, for instance, would combine with quicklime, caustic soda or potash to form carbonates or chlorides of these bases; but the calcium chloride would dry either of the gases named without such combination. On the other hand, oxygen or nitrogen, or the mixture of these gases as found in our atmosphere, may be dried by either of the solids named.

For drying gases on a small scale it is a common practice to place a quantity of the fragments of one or other of the above solids in a glass or porcelain tube, and force the gas through the tube, thus bringing it into contact with a very large surface of the drying material. For drying gases on a large scale, perforated trays for holding the drying material, over and through which the air or gas is made to pass, may be employed. This method of drying is very useful, especially when the air or gas to be dried contains some other substance besides water which it is desirable to remove and for which the drying material has a strong affinity. As an example, suppose oxygen gas to be mixed with carbonic acid gas and water vapor, the oxygen could be obtained pure by passing it over quicklime, which would take up both the water and carbonic acid.

It will now be seen that air having a strong attraction for moisture, when it is passed repeatedly over a substance which will yield its moisture to air, and then over a substance having a much stronger attraction for water vapor than air, will become a carrier of moisture. In this way very efficient drying may be performed in a cold temperature—that is to say, in any temperature above the freezing point of water.

Now air, at any temperature, attracts water vapor more or less strongly, according as the former is less or more charged with the latter. So no matter whether the temperature be high or low, air will have at such constant temperature a point of saturation beyond which it will not take up any more vapor; and the farther below this point of saturation it can be brought, the greater will be the rapidity with which it will take up and carry away moisture from the substance to be dried.

Chloride of manganese is a salt which, having a greater attraction for water than air, in the ordinary state, will deliquesce when freely exposed to the common atmosphere. Its crystals, therefore, are with difficulty obtained and preserved. If the attempt be made to expel the water by heat from a solution of this salt to the point of crystallization, a calcined solid mass results. But by the last method of drying described, beautiful large rose-colored crystals are easily obtained.

The solution, concentrated as far as possible by heat, is placed under a bell-glass, in which is also enclosed a vessel containing strong sulphuric acid. The air commences to slowly circulate in the bell-glass through the effect of unequal temperature. That portion which comes into immediate contact with the sulphuric acid becomes very dry, as this acid has a very powerful affinity for water. Now, as water vapor tends to diffuse itself uniformly through a volume of confined air, there is, apart from the feeble circulation in the confined space, a constant removal of water vapor from the air to the acid so long as the air can supply itself from any other source. Such source is chloride of manganese solution, which (the attraction of the air for moisture having been greatly increased by the action of the acid) now yields its moisture to the gaseous vehicle. After a few days of this action so much of the water of the solution will have been transferred to the acid that crystallization commences, and if the quantity of acid be properly proportioned to that of the solution, a mass of perfectly dried, handsome crystals may be obtained.

Doubtless, if means for effecting a rapid circulation of the confined air were supplied, this kind of drying might be greatly facilitated, as diffusion is a rather slow action.

Air and many other gases may also be dried by causing them to bubble through sulphuric acid, which seizes upon and retains the water vapor.

By circulating air through quicklime it may be made so thirsty for water as to become a powerful drying agent. Such air passed over fruit will dry it rapidly in the cold. The lime may be placed on trays in such manner as to expose as large a surface as possible to the air, which should be used over and over. When the lime has taken up so much water as to largely lessen its power to attract water, it may be renovated by placing it in a kiln on trays of a suitable refractory material, and heating to a bright red heat. This will expel the water and render the lime again active. Experiments performed by the writer many years ago lead to the belief that very economical and good results, both as to quantity and quality, may be thus obtained.

The Eruption of Mount Etna.

ONE of the crowding events that will mark the present year is the eruption of Mount Etna, which is doing immense damage. This ancient carbuncle on earth's fair bosom obstinately refuses to heal; it periodically inflames and breaks out, to the intense terror of the superstitious population that crowd around its base, who vainly hang crucifixes and images of saints in front of the advancing and consuming lava, in the hope of staying its destructive progress. Volcanoes and earthquakes may well excite superstitious fear, since all that science has been able to do toward solving their mysteries has been to frame a few theories, none of which seem satisfactory. Whether their origin is in the hidden action of vast mechanical or chemical forces, set free by gradual changes under the earth's crust, or by both, is still an unsolved problem. The probabilities are, that the forces which cause such disturbances are both mechanical and chemical; but little or nothing is known as to order of their action, the causes of their intermission, or the laws which govern their recurrence.

Obituary.

WE have to record the death of Sir William Fothergill Cooke, Knt., the projector and constructor of the first telegraph line in England. He was born in 1806, graduated at the University of Edinburgh in 1826, served in the East Indian army for five years, then proceeded to Paris and Heidelberg, where he remained pursuing scientific studies till 1836. At this time his attention was drawn, by some experiments of Prof. Moncke, to the subject of electricity, in the study of which he engaged with great ardor. In July of that year he had constructed an experimental instrument which operated successfully. He then associated himself with Prof. Wheatstone, and the first patent for an electric telegraph was issued to them in June, 1837. Afterward he entered into partnership with Wheatstone and Mr. J. L. Ricardo, M.P. From this co-partnership arose the first Telegraph Co., of which Cooke was a Director. The Order of Knighthood was conferred upon him in 1867.

The Molecule of Living Matter.

PROF. FAIRFIELD, of the New York College of Veterinary Surgeons, has just transmitted a paper to the Academy of Sciences, France, of which the subjoined presents a condensed abstract:

The following points are submitted by the undersigned to the Academy of Sciences, in the belief that, however extraordinary may seem the conclusions derived from them, the facts themselves will be considered of sufficient importance to be carefully examined and verified. The data rest, in the main, upon the testimony of a discovery of the writer respecting the properties of object-glasses, practically applied to the structure of lenses, by means of which he has been enabled to construct an objective of the focal distance of one millimetre, having, reckoned in diameters, 6.4 times, or, reckoned in areas, $40\frac{24}{25}$ times, the power of such an objective constructed according to formulæ now in use among the best opticians. The first objective constructed upon this principle was based upon a Bardou No. 10, of the ordinary continental pattern; the combination, with C eyepiece, and tube 0.4 of a metre or 15.6 inches in length, yielding, with fine definition and penetration, and extraordinary resolution, a power of 12,600 diameters. Applying the same formula to a wide-angle objective of one millimetre focal distance, the result has been a power of 50,400 diameters, as near as it is possible to calculate an instrument of such delicacy. The calculation of power was made in the following manner: With C eyepiece and tube undrawn, a wide-angle Wales objective of one millimetre focal distance was applied to the instrument, and the power, measured with an eyepiece micrometer, found to be 2,100 diameters. Placing a stage micrometer under the lens, the tube was then drawn until the diameter of the pencil of rays transmitted—that is, of the field of vision—was exactly 0.005 of an inch. On applying the Bardou as reconstructed, without alteration of these conditions, the diameter of the pencil transmitted was found to be 0.0008 of an inch, or a little less than one-sixth that of the Wales. At this power three colored corpuscles of human blood, placed in linear series, spanned the field of the instrument. The power could, of course, be found by the proportion: as .0008 is to .005 so is 2,100 to 13,125. I now slowly pushed in the draw-tube until the field of the Bardou was exactly one-sixth that of the Wales, and the power properly represented by 12,600 diameters, instead of 13,125. Upon this basis I then measured the field of the one millimetre (more properly, $\frac{1}{25}$ inch) objective, altered in the same manner as the Bardou No. 10, and found it to be exactly 0.00025 of an inch; yielding upon the proportion previously applied a power of 40,320 diameters. My next movement was to draw the tube until the diameter of the pencil was reduced to 0.0002 of an inch, and the power increased to 50,400 diameters.

I am fully aware how thoroughly fabulous such a statement of power must seem, about 10,000 diameters being the highest result obtained with

the Tolles $\frac{1}{75}$ inch, recently exhibited before the New York Academy of Sciences; but I trust I shall be believed when I affirm that, with an ample working distance, the Bardou No. 10 I have just described is superior in power, definition, penetration, and resolution to the Tolles; being, with the exception of the $\frac{1}{25}$ inch more recently constructed, the most powerful microscope objective in the world. An entire corpuscle of human blood cannot be viewed at one time with the $\frac{1}{25}$ inch as now arranged, and it requires only ten of the little bodies styled monads to fill the worker's vision completely. Yet the defining, penetrating, and resolving properties of the lens are perfect, and the perimeters of the monads are sharply defined.

My first step in the investigation that followed was to ascertain by calculation how small an object the instrument, as thus modified, was capable of visualizing. By experiment, when mounted in balsam or glycerine jelly, I first ascertained that my right eye, unassisted by lenses, was capable of detecting the presence of an object $\frac{1}{300}$ of an inch in diameter, held between it and a clear and steady light. Then, by proportion, as 50,400 is to 1, so is $\frac{1}{300}$ to the diameter to be found. The result thus arrived at is, that an object $\frac{1}{15120000}$ of an inch in diameter could be distinguished, though not described, with the lens by means of which my work was to be conducted.

The next point was to form some proximate notion of the diameter of the molecule of living matter. It is useless to argue that an atom or equivalent has no dimensions, for the reason that extension is a property of matter, and, without going into metaphysical speculation, any sub-division of matter that is conceivable must be conceived as having extension. No words need be wasted here. If there is such a thing as an equivalent, or such a thing as a molecule of water or of albumen, such atom and molecule have the property of extension. They may be minute beyond conception, but so, comparatively speaking, are many other microscopic objects. According to calculations based upon the best data at hand, it takes not less than 10,000,000 of molecules placed in linear series to cross a grain of sand $\frac{1}{300}$ of an inch in diameter. The molecule of inorganic matter is thus seen to lie beyond possible optical analysis. But as some living compounds contain 90 equivalents, instead of 3, and as the structnre of living matter is comparatively less solid than that of inorganic, it may be concluded that its molecule is at least 30 times in diameter that of a molecule of sand. Take the following formula as an example: $C_{39}H_{25}N_{15}O_{11}$ + hyposulphurous acid, a trace; and nearly 100 equivalents in all must be considered as making up the complex molecule of albumen. Such a molecule might possibly lie within optical limits, with a clear and distinct illumination. Next in order come the data of experiment. When a film of albumen from the white of an egg is pressed between two glasses, or placed upon the surface of a slide and pressed beneath a cover of the smallest available diameter, it commences to break up into vacant spaces and lacunæ at a thickness of $\frac{1}{100000}$ of an inch. As albumen is extremely viscous, it will scarcely be maintained that its power of cohesion would give way at a less maximum than 100 molecular thicknesses; and, this being the case, $\frac{1}{10000000}$ of an inch may be stated the minimum diameter of the molecular subdivisions of a drop of albumen. My $\frac{1}{25}$ double-system objective leaves me, upon this basis, a margin of 50 per centum over and above the calculation from experimental data; and if, in studying the surface of a colored corpuscle of blood or a film of albumen, it reveals anything beyond the revelation of 5,000 diameters, it may be concluded, with considerable show of probability, provided the something revealed is regular in its structure, that the molecular constitution of the compound has at last been brought under the purview of direct optical analysis.

The most extraordinary fact in the study of a film of albumen at this power is, that the whole optic field seems to be alive with minute globular bodies, having a slight, tremulous movement, without alteration of position in relation to each other, but associated by minute threads. In a similar way the surface of a colored corpuscle shows a curious but extremely delicate reticulation, with almost imperceptible globules at points where the minute filaments unite. The albuminous globules are not more than $\frac{1}{9000000}$ of an inch in diameter. That is to say, it would require 750,000 of them to form a monad or a lymph granule, and millions upon millions to form a single colored blood corpuscle; or, to express the matter in figures, not less than 27,000,000,000 to occupy the space of the smallest cell known to histologists To the microscopic expert, who bears this inconceivable minuteness in mind, and remembers that the smallest cell bodies are $\frac{1}{5000}$ of an inch, the smallest granules never less than $\frac{1}{35000}$ of an inch, and the minutest monads seen in such animal secretions as tears and saliva at least $\frac{1}{50000}$ to $\frac{1}{75000}$ of an inch in diameter, it is not necessary to say that a new department in the study of living matter has been opened, and its molecular constitution probably verified. The value of this new department must be left to future observations.

I have examined so far probably 50 specimens of albumen, as many colored corpuscles, and a larger number of granules and monads, with a view to determine whether the points I have just described are universal to living matter or merely special to certain compounds. In the fresh granular matter of the brain I find these molecules (if I may so style them) somewhat larger than in albumen. In the germinal spot of an impregnated egg, when examined immediately, I find them in rapid movement and constantly altering their relations to each other. Proper caution forbids that I should assume this new field to be molecular until tested by further and more exact calculations based upon experiment. All that I shall at present claim is the discovery of a new department in the direct optical study of vital phenomena. What may be the ultimate result to science of further researches, experimental and optical, it would be rash as well as premature to predict. It may be very properly stated, however, that the monad now ceases to be the ultimate known subdivision of living matter, and that unless there is a connecting link between the monad and the molecule, the latter will be optically understood, and actually measured and described, before the nineteenth century is folded up and laid away in the great magazine of the past.

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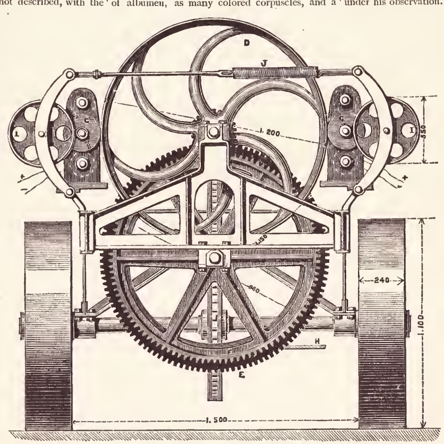


TRANSVERSE SECTION ON LINE A.B.

PLOUGHING BY ELECTRICITY. (FOR DESCRIPTION, SEE PAGE 157.)

A Large Oil Pipe Line.

AN oil pipe line from the centre of the Bradford district to Williamsport, Pa., called the "Tide Water Line," has just been completed, and gone into operation. It is designed to relieve a large number of producers, by conveying the oil about 100 miles to a connection with competing lines of railway. This is the first six-inch oil-pipe of any length yet laid. It weighs nineteen pounds to the foot, or almost fifty tons to the mile. The oil has to be raised over an elevation of twelve hundred feet, at a point thirty-one miles east from Coryville. From this point to Williamsport the oil has a fall of twenty-one hundred feet. With the application of four hundred pounds' pressure to the square inch at the second pump station, the oil is driven to Williamsport at the rate of six thousand barrels daily. This is the lowest rate at which the lines will be worked, and it is capable of doing considerably better. The line cost $800,000.

Physical Action of Turpentine on Workmen.

AT a recent sitting of the Academy of Sciences of Paris, a paper on the subject was read by Dr. Poincarré, a professor attached to the Faculty of Sciences at Nancy, who has had occasion to study the effects of turpentine on 284 painters coming under his observation. From his researches in this direction, and from comparative experiments made upon various animals, Dr. Poincarré arrives at the conclusion that the injurious effects produced by turpentine fumes can never be sufficiently severe to cause death, unless they be volatilized in an extremely confined space. Where there are free movement of the air and good ventilation, there need be no fear whatever of fatal accidents from this cause. He further remarks that the vapors of turpentine coming from different sources have not all the same energy; that of the French product, for instance, being far less injurious than those of Hungarian or American turpentines. Lastly, such evil effects as are produced are mostly in the cases of workmen unused to the trade, a very short time sufficing to case-harden or acclimatize them thoroughly. The most general form of indisposition met with among them, which may be directly attributed to the turpentine, are headache, watering of the eyes, coryza, cough, granulations on the larynx, and disordered digestion.

PATENT CONTEST ENDED.—After an interference lasting for four years, the Commissioner of Patents has granted a patent to R. Hoe & Co., of New York, assignees of L. C. Crowell, of Boston, for the combination with a rotary web perfecting printing machine of a web severing mechanism and a rotary sheet-folding machine, which invention is now used by the principal newspapers of the country. It is understood that a number of New York newspapers, using one or another adaptation of this mechanism, manufactured by rival houses, will now have to settle with Hoe & Co. for the same, if indeed they do not have also to stop using it.

THE order of Knighthood has been conferred upon Mr. Bessemer, the inventor of the process which bears his name.

MESSRS. SIEMENS & HALSKE have, it is stated, invented what is called a differential lamp, by which the electric arc is divided in a manner hitherto unknown.

IT is stated that paper has been successfully applied as a material for brake-blocks. It is cheap, easily fitted, and while as effective as wood or cast iron, it does not injure the tires, nor throw off numerous fine particles of iron, which have been found a great nuisance on the New York Elevated Railroad, in consequence of the rust.

LIFE OF RAILWAY ROLLING STOCK.—The Illinois Railroad Commissioners have obtained returns from twenty-six railway companies, which show that the "life" of a locomotive engine varied on these railways from eight years to twenty-four, and that the general average duration was fifteen and a quarter years. Passenger cars endure from eight to twenty years—the average being fifteen and three-quarter years; the average life of stock cars being ten years, and that of freight cars eleven and a half years; and railway bridges of wood endure from five to twenty years. As to the life of rails, the statistics seem to indicate that those of iron last from three to twelve years - the mean being seven; while steel rails are credited with from nine to twenty years' service—and an average of fourteen years is obtained from the returns.

Wheat Straw Lumber.

A gentleman of Bushnell, Ill., recently exhibited some samples of lumber that have attracted much attention among the lumbermen.

To make hard wood lumber of common wheat straw, with all effects of polish and finish which is obtainable on the hardest of black walnut and mahogany, at as little cost as clear pine lumber can be made up for, is the claim of the inventor, and the samples which he produces would go far toward verifying his claims.

The process is as follows: He takes ordinary straw board — such as is usually manufactured at any paper mill is used for the purpose. As many sheets are taken as are required to make the thickness of lumber desired. These sheets are passed through a chemical solution which thoroughly softens up the fibre and completely saturates it. The whole is then passed through a succession of rollers, dried and hardened during the passage, as well as polished, and then comes out of the other end of the machine, hard, dry lumber, ready for use. The inventor claims that the chemical properties, hardening in the fibre, entirely prevent water soaking, and render the lumber combustible only in a very hot fire. The hardened finish on the outside also makes it impervious to water.

The samples on exhibition could hardly be told from hard-wood lumber, and in sawing it the difference could not be detected.—*Oskosh Northwestern.*

Remarkable Feat in Railway Reconstruction.

CHANGING THE GAUGE ON SIX HUNDRED MILES OF ROAD WITHIN ABOUT TWELVE HOURS.

The *St. Louis Post Dispatch* publishes an account of one of the most remarkable feats in railway reconstruction ever performed—the change of gauge on the St. Louis, Iron Mountain and Southern.

Heretofore the gauge has been five feet. About six weeks ago the Board of Directors of the Iron Mountain adopted a resolution providing for change of gauge to four feet, eight and one-half inches, and immediately thereafter Mr. Thomas Allen, the President of the Company, gave the order for the work to be done. Active preparations were begun at once.

Extra men were employed, and all the shops began to run on extra time. Every locomotive and every car had to be cut down for the new gauge, and much of this had to be done beforehand, so there would be no interruption of business. The actual work of changing the track began at night at some points as soon as the midnight trains had passed. Over 3,000 men were employed for the occasion. The men were divided into squads, and each squad was put under the charge of a "boss." The "bosses" were under the direction of the roadmasters, and the roadmasters were under the direction of the division superintendent, the whole being under the supervision of the general superintendent.

There are four divisions of the Iron Mountain Railroad. The Texas division is 145 miles in length; the Arkansas division is 180 miles in length; the Missouri division is 196 miles in length, and the St. Louis division is 172 miles in length.

A number of sections were finished by 6 o'clock the next morning, and by 2 o'clock in the afternoon the whole vast work was accomplished. Over 600 freight cars, sixty engines and all the passenger coaches had been cut down and were ready for the new gauge, and the regular business of the road was interfered with only about six or seven hours.

How to Wind Spiral Springs.

BY JOSHUA ROSE, M.E.

FOR this purpose a mandrel, such as shown in Fig. 1, is employed, the spiral groove being made to the pitch the required spring is to be. The diameter of the spiral should be slightly less than the required diameter of spring, because the spring unwinds a trifle as soon as it is released from tension around the mandrel. The mandrel must be sufficiently longer than the required length of spring to admit of the application of a lathe dog to drive it, allowing sufficient clearance between the end of the spiral groove and the dog. Near one end of the mandrel a small hole is drilled through, there being sufficient space between the hole and the end of the mandrel to admit of a loose washer being placed thereon; the bore of this washer requires to be rather larger in diameter than the outside diameter of the spring, when wound upon the mandrel, and also requires to be provided with a keyway and key. We may now proceed to wind the spring (supposing it to be made of wire sufficiently light to admit of its being held in the hand during the winding process). Slipping the washer over the mandrel, we place the latter in the lathe between the centres, and then slide the loose washer back against the dead centre of the lathe; we then pass the end of the spring wire through the hole in the mandrel, pull it tightly against the mandrel, and bend it over the corner of the hole by tapping it lightly with a small hammer. We are now ready to wind the spring as shown in Fig. 1, in which A represents the mandrel, B the small hole with the wire inserted, C the wire, D the loose washer and E the driver. While keeping a stiff tension on the wire by pulling it against the mandrel, start the lathe and wind the spring, closing it around the mandrel, if it does not wind closely, by tapping it with a hammer. When the spring is wound to the requisite distance slip the washer up and drive the key home, as shown in Fig. 2, and then cut off the wire.

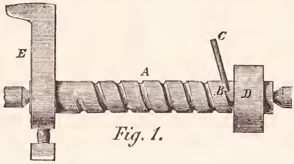


Fig. 1.

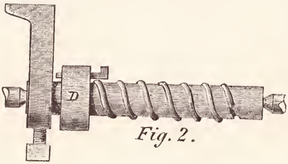


Fig. 2.

If the wire is too stiff to be held by the hand against the mandrel with sufficient force to cause it to bend closely round the mandrel, while the lathe is slowly revolving, we must, if the lathe is a self-acting one, put on the gearing, necessary to cut a thread of the same pitch as the spring requires to be, and then fasten in the tool-post of the lathe a grooved piece of metal as shown in Fig. 3, A representing the mandrel shown in section, B the spring wire, C the piece of metal acting as a guide and also to bend the wire close to the tool-post of the lathe in which C is fastened. If the lathe is not a self-acting one and has a hand-slide rest, we may take the feed screw out from the straight feed of the rest and use the metal guide, thus allowing the groove to carry the wire along, the grooves being in this case at least as deep as ⅛ of the diameter of the wire. Having wound the spring, we must place the washer in position, as shown in Fig. 2, and cut off the wire. Then if the wire is of brass we must take it to an anvil or iron block and well hammer it all over its circumference, not promiscuously, but beginning at one end and following along the wire with the blows delivered not more than ¼ of an inch apart; for unless we do this we cannot maintain any definite relation between the size of the mandrel and the size of the spring. If, however, the wire is of steel we must take the mandrel with the spring wound on it and fastened by the washer as shown in Fig. 2, and heat them to a very low red heat so as to set the spring to the mandrel, because the hammering process would only tend to close the grain of the metal, and thus add to its elasticity without having much effect towards closing the spring around the mandrel, except the spring be made of very small wire.

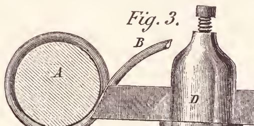


Fig. 3.

If it is not essential that the coils be exactly true, take a plain mandrel, such as shown in Fig. 4, and a hook, such as shown at A, fasten the end of the wire either around the lathe dog, or in a hole in the mandrel as before, and wind one full coil of the spring upon the mandrel, then force this coil open until the hook end of A can be inserted between it and over the mandrel, the other end hanging down between the lathe shears, which will prevent it from rotating, starting the lathe while holding the unwound end of the wire against the hook with a slight pressure, and the winding will proceed, as shown in the figure, the thickness of A regulating the width apart of the coils. It is obvious that if the coil is to be a right-handed one and is started at the carrier end, the lathe must revolve backwards.

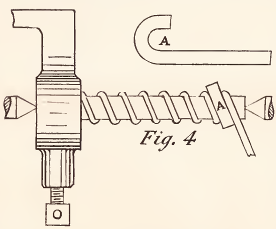


Fig. 4

VEGETABLE IVORY.—The vegetable ivory now largely used in the manufacture of small ivory articles is the hardened kernel of a species of palm, principally the Brazilian palm (*Phytelephas Macrocarpus*), which grows freely in Central America and Peru, and yields what is known as the corosos nut of commerce. When shipped, it is asserted that the kernels are as soft as white wax, and during the voyage they ripen and become hard. The use of this material is, we are informed, annually increasing.

ADHESION OF MORTAR.—In building the Pont de Claix, some experimental blocks were joined by mortar, which was allowed to harden for three years, when the mortar was broken by an average load of 10.0125 kilogrammes per square centimetre (142.228 lb. per square inch). This experiment seems to show that the adhesion of mortar to stone is only about one-third as great as the cohesion of the mortar itself. The result is noteworthy, as this adhesion is the true measure of the resistance of masonry. Further experiments of a similar kind are desirable, in order to establish formal conclusions.—*Ann. des Ponts et Chauss.*

THE strike of the cotton spinners at Fall River, Mass., is still in progress, the mills being partly operated, and gaining new workmen daily. The mill owners are determined not to surrender, and if they cannot secure sufficient new men to run the mills, will allow them to stand idle. The strikers have appealed to the workmen of the country for assistance.

Gear-Cutting Attachments for Lathes.

The Hopkins gear-cutting attachment for lathes, illustrated in the accompanying engraving, is manufactured by Messrs. Jackson & Tyler, No. 27 German Street, Baltimore, Md. We are indebted to the *American Journal of Industry* for the following description:

The size of gears cut depends upon how coarse and heavy the work is. The general limit is from seven to eight inches in diameter. The best lathe to use it on is 10, 20 or 24 inch swing. It can be used on a 16-inch swing lathe, but is somewhat crowded. The index pulleys can be detached and used independently of the other parts for many purposes about the shop.

The work is operated upon by a cutter turning upon the centres of the lathes, and is held and governed by the means represented in the illustration, and described below.

A is the arbor box, in which freely turns a hollow spindle, B. Through the latter passes a tapered arbor, C, on the upper and larger extremity of which the gear wheel to be cut is secured. Fastened to the hollow spindle by means of a set screw, and hence rotating with it, is the index pulley, D. Attached to the arbor box is an arm, in which is a slot, in which travels an index point, E, connected with a suitable spring, which holds its extremity in one of the orifices on the pulley, D, to which it may be adjusted. Rows of different numbers of these apertures around the pulley, D, provide various graduations; and from the pointer, E, traveling freely along its slot, it may be readily placed over any desired row. The number of holes in each row is marked upon the face of the side clasp, F, directly over each series of apertures. The clasps slide entirely around the circumference of the index pulley, and can be used to mark the number of holes passed under the index point, serving the purpose of the spacing fork on common gear-cutting machines.

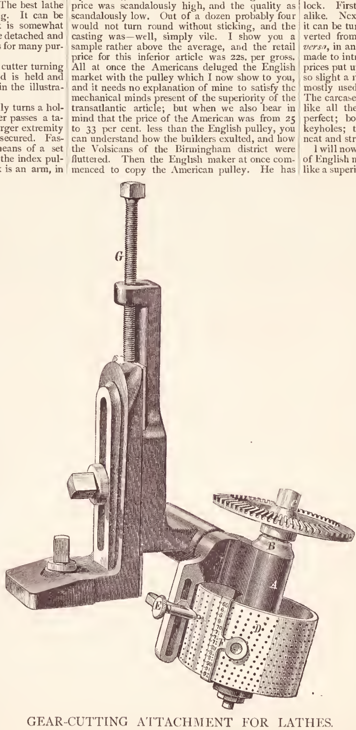
Any graduation under 100, and all even numbers up to 130, can be cut. All these graduations are actually here—no complicated, intricate arrangement to perplex and bother. The construction of the device is of the most careful description, well calculated to insure durability and efficiency. It will be noticed that when using this apparatus the action of the cutter upon the work can be conveniently and carefully observed as it progresses, without stopping.

SIGNS OF FUTURE PROGRESS.—Mr. Conrad W. Cooke, in a recent paper read before the Society of Arts, London, expresses the following hopeful view of the future of science and invention: "It must be evident to every person who watches the signs of the times, that the world is now passing through a period in its history especially characterized by its richness in scientific research, in philosophical discovery and in fertility of invention. The age in which we are living is essentially a scientific age, and an age of thirsting after scientific truth. Inventions and discoveries follow one another with such extraordinary rapidity that there are persons who imagine that this onward march of scientific progress cannot continue much longer, that the end of discovery must in time be reached, and that all will have been found out that has to be discovered. In addressing such an assembly as the one I see before me, it would on my part be presumptuous, as well as superfluous, to refute so shallow a supposition; but I may be permitted to express my firm conviction that as, throughout the whole of the world's history, each period has been richer in scientific discovery than any that have preceded it, so will this onward march of progress continue. Facts will go on being added to facts, inventions will follow inventions, and at a far more rapid rate during any one half century than in any of its predecessors, for every discovery of science leads to a new group of inventions, and each invention repays the debt by rendering possible and facilitating the acquirement of fresh philosophical facts. The depths of nature are absolutely unfathomable; we may go on adding bit by bit to our sounding line, we may take out of her vast ocean bucketful after bucketful of the wealth with which she is stored, but we shall never reach the limit of her depth, or lower the level of her riches by a single inch."

American vs. English Manufactures.

Mr. F. Smith, in a paper recently read before the Manchester (England) Scientific and Mechanical Association, made some severe strictures upon English and gave correspondingly high praise to American manufactures, particularly in builders' hardware. He said:

Some two or three years ago ordinary axle-pulleys of English make were difficult to get. The price was scandalously high, and the quality as scandalously low. Out of a dozen probably four would not turn round without sticking, and the casting was—well, simply vile. I show you a sample rather above the average, and the retail price for this inferior article was 22s. per gross. All at once the Americans deluged the English market with the pulley which I now show to you, and it needs no explanation of mine to satisfy the mechanical minds present of the superiority of the transatlantic article; but when we also bear in mind that the price of the American was from 25 to 33 per cent. less than the English pulley, you can understand how the builders exulted, and how the Volsicans of the Birmingham district were fluttered. Then the English maker at once commenced to copy the American pulley. He has



GEAR-CUTTING ATTACHMENT FOR LATHES.

not yet succeeded in producing such a beautiful casting, but I venture to say that he has improved the quality more in the last eighteen months than in the previous eighteen years. For generations the English builder and householder has had to be content with the stereotyped door furniture, with all its aggravating propensities. The little screw (so small as to be scarcely perceptible to touch or to sight) shakes from its countersunk depression in the spindle, gets loose, and lets the knob go adrift; or the knob itself, formed of a bit of sheet brass, turns round on its shank and the door cannot be opened; or the shank, not having a sufficient bearing on the spindle, works loose, and the whole thing is out of repair. I have here an ordinary cheap set of china furniture of English make, which I dare not drop lest I should break it; but, as you see, I dare throw its Yankee competitor the whole length of this room. The retail price of this English set is ninepence—the price of the American is less than sixpence. The English spindle is fitted with the usual little screw, the knob is loose, the roses are china and liable to break with the least strain or blow. The American set, as you see, has a long shank; the form of the knob is a very oblate spheroid, giving a good grip and free play for the fingers between the knob and the door. The rose is japanned iron, and has small studs or teeth projecting on its inner side, effectually preventing it from turning round with the spindle; the screw is strong, and is tapped through the spindle itself, ensuring both security and perfect steadiness.

I will now show you a cheap American rim-lock. First you will notice that both sides are alike. Next, that by pulling the latch forward it can be turned half round, and is thereby converted from a right hand to a left hand, or *vice versa*, in an instant. Several attempts have been made to introduce locks of this kind, but the fancy prices put upon every article which departs, in ever so slight a measure, from the antediluvian patterns mostly used, practically prohibits their adoption. The carcase of the lock is of cast iron; the casting, like all the small American castings, is simply perfect; bosses are cast round the follower and keyholes; the box staple is one piece of metal, neat and strong.

I will now show you an ordinary six-inch rim-lock of English manufacture. At a short distance it looks like a superior article; the follower and keyhole appear as if they were bushed with brass. But let us take it to pieces and see what we can find. The follower is a rough casting, not turned at the bearings, and is in no sense a fit. The screwholes are not countersunk, but merely punched in; the key is of the roughest and worst-fitting description; the inside is as rough and cheap as possible; the key is cut so as to deceive the purchaser in the belief that there are twice as many wards in the lock as is really the case, and the bushes prove to be thin plates of brass riveted on, and not bushes at all. In short, the whole article is a vile fraud and the maker was a swindler.

Next take the box-staple. As is usual, it is fearfully and wonderfully made of sheet iron, square iron and brass, the outcome of which is that the showy brass striking-piece comes unriveted, the door comes unfastened, and the tenant's temper comes unhinged. Why, in the name of common sense, could they not substitute a neat malleable casting? In our own houses I have long since discarded the ordinary box-staple for draw-back locks, and find it cheaper to buy a cast iron staple, and throw away the one supplied by the English lockmaker. When I tell you that the American lock, fitted with the mineral furniture, is at least 25 per cent. cheaper than the English abortion I have shown to you, you will realize what our English markets have to fear from the Americans. Here is a common, cheap, English mortise-lock, and you will naturally ask why the outside of this lock is ground bright, when it is buried in the door, and never seen except it has to be taken out for repairs. I have asked the same question, and for twenty years have paused for a reply. This lock is not reversible, the follower is not bushed, and the inside is rough and cheap. Contrast it with this neat American lock, and notice again the bosses to receive the wear; notice, also, that the bolts are brass; the latch-bolt is, of course, reversible. I never saw an American lock which was not. The body of the lock is cast iron; and, seeing that there are no strains upon a mortise-lock, it is quite as good as if it was of wrought iron. There is no unnecessary grinding, but the iron is japanned, and the japan is as much superior to the English compound as is the lacquer ware of the Japanese to that which is executed in Birmingham and palmed upon the ignorant buyers as Japanese work. In fact, as you see for yourselves, the English japan looks almost like gas-tar beside the American. This American lock is a two-lever, and there is no sham about the key, which is made of some kind of white metal, and is small and neat. This lock is only 2½ per cent. higher in price than the English.

I now show you two thumb-latches—one of American and one of English make. Notice the general finish of the American latch: the shape, the mode of construction and everything about it proves that brains were used when it was designed and made. The English "Norfolk latch," on the other hand, is ill designed, uncomfortable in hand, clumsily finished; the japan hangs about it in lumps, the latch is clumsy, the catch is clumsier,

and the keeper, a rough piece of hoop-iron, seems as if designed to "keep" the latch from doing its duty. In this case the American latch is twenty-five per cent. cheaper than the English one; and the English latch is of the same pattern as the one that was in use when I was a boy, only that it is a greatly inferior article.

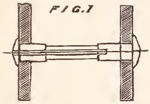
I will now introduce you to the well known nuisance which we have been accustomed to use for fastening our cupboard doors—the cupboard turn—and, without further comment, ask you to compare it with this neat and simple latch of American make, costing about five per cent. more, twice as efficacious and five times as durable. In this case no improvement has been made in the English fastener. It is just as it was when I went to the trade, about twenty-eight years ago; and although many attempts have been made to improve it, they have added so much to its cost as to prevent the improved articles from coming into general use.

Locomotive Fire-Boxes.*

I.

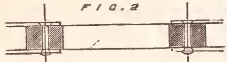
The fire-box is an almost square box, inclined at the bottom for the coals on the fire-bars to fall to the back, and generally made of the best copper of about ½ inch thick. It is stayed by copper stays (see Fig. 1) ⅞ inch thick at about

FIG. 1



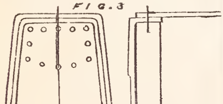
4 inches pitch, the lowest line of copper stays running parallel to the bottom ring, and the top rows being a little distance off the crown of the fire-box. It is also stayed to the boiler by the fire-door ring—a wrought-iron oval ring of a square

FIG. 2



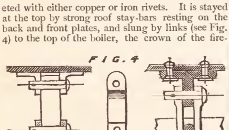
section (see Fig. 2), having holes drilled through it for iron rivets. The copper box may be made of three or five plates (see Fig. 3), and may be riv-

FIG. 3



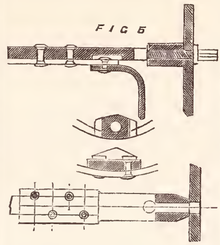
eted with either copper or iron rivets. It is stayed at the top by strong roof stay-bars resting on the back and front plates, and slung by links (see Fig. 4) to the top of the boiler, the crown of the fire-

FIG. 4



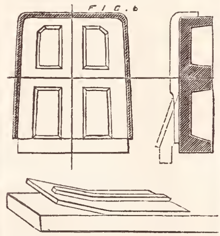
box having bolts through it and being separated from the roof stay-bars by wrought-iron ferrules, which are a loose fit on the screw bolts. As the crown of the copper box is flat, all the steam pressure on the top falls on the roof stay-bars, which are, therefore, made of a girder form, with plenty of depth. It is frequently noticed that the holes in the tube-plate assume an oval shape, which may be attributed partly to the steam pressure on the crown, and partly to the weight of the stays and tubes. The part of the copper tube-plate perforated with holes is made of an extra thickness, while the lower part is inclined a little outwards, which reduces the water-space. The copper box is also stayed to the shell of the boiler by four or five stay-bolts, screwed tightly into strips of iron riveted to the shell (see Fig. 5), and made steam-

FIG. 5



tight inside the copper box. These strips should have a small circular-bearing surface on the copper box, so that the joint may easily be made steam-tight, and should be made so as to catch as little mud as possible. Sometimes (see Fig. 6) the *same bending block* will do for the

FIG. 6



front and bind plates of the copper box, except when the tube-plate is beveled. The bending block is often provided with a large iron slab, which is let fall on the copper plate after the flanges have been turned down with mallets; this flattens and partially softens the plate. The flanges are afterwards made the right size on a planing machine, and rivet-holes drilled in the flange all round in a horizontal multiple drill. Holes are tapped in the crown, in the spaces between the roof stay-bars, for safety plugs. There must be plenty of bearing surface for the ends of the roof stay-bars, which have to be filed and chipped to fit the copper box, a job which is always rather troublesome. Several attempts have been made to shape the ends of the roof stay-bars to templet, but without success, partly from the inequalities of the copper box and partly from the awkward shape of the roof stay-bars, which have no true surfaces for setting, and, of course, the copper box could not be touched after being riveted together.

* F. Hoffman in *English Mechanic.*

Pumping Money.

The above may appear to be a somewhat singular title for a paper, but it is literally true that a vast number of sovereigns, and, indeed, of other coins, are annually pumped into existence at the Royal English Mint. Without entering into a detailed account of the numerous processes and manipulations by means of which ingots of gold are transformed into small circular discs of metal, of the exact size, and standards of weight and of fineness for the reception of impressions, it may be said that those impressions are finally due to the action of the air-pump. A very large proportion of the sovereigns, therefore, issued from the Mint presses since the erection in 1810 of steam machinery for the purpose of coining have undoubtedly been pumped, as it were, into the channels of circulation. Let us, then, proceed to explain the contrivances and means by which the operation of pumping sovereigns is performed at the Tower-hill money manufactory. We will commence with the prime mover. This is a steam engine of 20 horse power, on the combined high and low pressure principle, and which was erected in 1846 by the justly celebrated firm of George and Sir John Rennie. Originally this engine was intended only for pumping water from a deep artesian well on the premises for the supply of the coining department, but in 1851 Mr. J. Newton advised that the engine in question should be made to pump money as well as water, and showed how it could be done. The merit of entertaining the proposition and of ordering it to be carried into effect certainly belongs to Captain (now General) Harness, R.E., who was Deputy-Master of the Mint in the year named. This highly talented officer gave instructions to the Messrs. Rennie for the construction, under the eye of the inventor, of the necessary apparatus and appliances for the purpose.

An air-pump of considerable dimensions constituted the main feature of the scheme, and this was formed on a perfectly novel plan. It consisted of a cast iron cylinder, closely resembling in exterior appearance that of an ordinary land steam engine, but very different in its internal arrangement. The piston of the pump was made up of a series of cast iron rings, and these were pressed out against the sides of the accurately bored cylinder by springs of steel. The effect was to make the piston perfectly air-tight, and yet capable of being easily moved upwards and downwards in the cylinder. There were no valves in the piston, as there are in those of almost all air-pumps employed in manufacturing processes. The base of the cylinder was a hollow casting of iron, and so was its cover. In these hollow castings the inlet and outlet valves were placed. The upper casting contained sixty-four small apertures, which were covered by small pieces of steel saw-plate, each about two inches long by one inch wide, and fastened by a screw at one end. These delicate springs were, in fact, the valves. Thirty-two of them were made to open to the atmosphere, and thirty-two to the exhaust or vacuum pipe. The hollow base or bed-plate of the cylinder was furnished in a precisely similar manner. The diameter of the cylinder was 3 feet 6 inches, and the length of stroke of the piston 3 feet. The pump was placed vertically, and immediately below the working-beam of the engine to which the piston-rod was attached.

By this method of construction the air-pump became double-acting, and whether the piston was ascending or descending it constantly exhausted air from the vacuum tube through the inlet valves, and discharged it through the outlet series. Nothing in the shape of machinery could work more smoothly than did this pump, and this arose mainly from the peculiar character of the valves. The cost of the whole apparatus, with cast iron exhaust tube, 200 feet in length, 10 inches in diameter, and face-jointed, was about £400.

It has been said that the exhaust tube was 200 feet in length. This arose from the fact that the engine house had been erected at that distance from the stamping presses. Instead of being carried underground, as in the Pneumatic Dispatch system, the tube was in this case carried over the roofs of the coining rooms, and, descending therefrom, was attached to the great vacuum chamber.

The "vacuum chamber" had existed from the period of the erection of the Mint, and was originally devised by Messrs. Boulton & Watt, the well-known engineers of Soho. They had supplied a steam engine of 10 horse power, and two single-acting air-pumps, each of which discharged air only in its downward stroke, for exhausting the chamber. This cumbrous and comparatively costly, though for its day very ingenious and valuable arrangement, was set aside when the new air-pump came into use. It had performed its mission, and was henceforth to be reserved as a duplicate in the event of the derangement, by accident or otherwise, of its modern supplanter. A regulating, or relief valve, and a barometer gauge fitted to the vacuum chamber, enabled the attendant to control and adjust the extent of rarefaction within the latter.

It will now be comprehended that at all times when the engine and pump are in action a vacuum of more or less extent must exist in the chamber. The chamber, it may be explained moreover, is a horizontal tube of iron about 50 feet long, and 2 feet 6 inches in diameter. It runs along the floor of the Mint pump room, in a line parallel to that in which the eight coining presses stand. Arranged along the top of the vacuum chamber, and supported by pipes opening into it, are a series of eight cylinders. These are vertical and fitted with pistons, the rods from which are connected by levers and cranks with the presses. The cylinders are open-topped, and consequently their pistons are exposed to the pressure of the atmosphere once a vacuum exists below them. This is the case when the pneumatic valves within the cylinders open to the vacuum chamber. The air within the cylinders then rushes down to the exhausted tube, the atmospheric column drives the pistons after it to the bottom of the cylinders, and the pistons drag with them the central screws of the coining presses. The instant that the beautifully engraved dies are

thus made to come into contact with the discs of gold, the latter receive by the force of impact their impressions. The presses then rebound, carrying with them their pistons. The pneumatic valves again open self-actingly, the dies descend upon new blanks supplied to them by mechanical fingers, another batch of sovereigns is pumped into bright and glorious being, and so long as the great air-pump is exhausting the vacuum chamber and the presses are fed with blanks, so long the series of minor pumps will proceed with their work, and streams of gold, silver or bronze coins will flow down from the presses into reservoirs placed below to catch them.

Relation Between Size of Windows and Rooms.

IT seems a self-evident proposition, yet one that is continually disregarded (says the American author, Aston Webb), that the size of the windows must be regulated by the size of the rooms they are intended to light; yet nothing is more common than this example, where three windows all of the same size, "to preserve the uniformity of the elevation," as the speculative builder says, light three rooms of totally different sizes, the result being that one bedroom is fairly lighted, the other is very dark, while the dressing-room is so light that you hardly dare dress in it without the blind being drawn down, as you seem to be quite out in the open air. It is extremely difficult to lay down any law giving exact rules as to the proportion of lighting space necessary for a given room—much depends, for instance, on the position of the light; in the well-known example of the Pantheon at Rome the building is amply lighted by a small circular opening in the roof; the cubic contents of this building are given at 1,934,460 cubic feet, and the area of the circular opening only 572 feet, or about one-third the amount required had the lighting been from the side.

The rule said to have been adopted by Sir William Chambers is to add the depth and height of the room together, and an eighth of the result will give the width of window. Gwilt gives as a general rule one foot super of light in a vertical wall to every 100 cubic feet in the room.

Robert Morris says that the superficial area of the window should equal the square root of the cubical contents of the room. This, however, though no doubt approximately true, must evidently be open to large variations according to the width of the street, and especially according to the aspect and the climate, and the exact size of certain windows to suit certain shaped rooms can only be learned by observation and experience. The matter is one of the greatest importance, and cannot be too carefully considered. It should also be borne in mind that certain rooms will require more lighting than others; a drawing-room more than a dining-room, a dressing-room more than a bedroom, and so on. And if this is carefully attended to (and, of course, taste and discrimination used), the elevation will be at least an honest and truthful one, and you will not find the principal windows on the ground floor lighting, as is often the case, a cloak-room or a w.-c.

THE cost of the late Durham strike in England is estimated at $3,200,000; nearly half is borne by the men. Without reckoning interest, it is computed that it will take 9¼ years to make up the sum lost.

Improvement in Clothes-Line Holders.

THE accompanying engraving illustrates a cheap and good invention recently patented through the Scientific News Patent Agency, which obviates both the inconveniences and dangers of hanging clothes upon lines extended from windows above ground as ordinarily practiced in cities, especially in French flats and tenement houses. Several serious accidents caused in this way have lately been reported in the daily papers; in one instance, we believe, death having resulted from a fractured skull and concussion of the brain, produced by a fall from a three-story window. By the employment of the device shown in the engraving, the end of the line which is actuated to carry the clothes out from the building may be brought entirely into the apartment, and to such a distance that the clothes may be attached to the cord in perfect ease and safety.

A supporting bar, or arm, is pivoted to the lower part of the side of the window-frame. To the top of this arm is attached a pulley, over which the line runs. A plate with holes and a pin near the bottom of the supporting arm serve to hold the latter in position during the operation of placing the clothes on the line. When the clothes

are attached to the line and run out into the air for drying, the line is made fast by a screw-clamp attached to the side of the window-frame, nearly on a level with the line where it passes out of the window. The line being thus permanently clamped, the supporting bar is detached from its attachment at the bottom and removed till again needed. The pulley is also detached from the supporting arm, and is allowed to hang down outside of the window. This permits the closing of the raised sash. The device is simple and easily applied, and ought to be generally adopted.

The patentee is Mr. William W. Gledhill, of this city. Agents are desired for all cities and towns in the United States. Further particulars may be obtained from Mr. Whit. H. Swayze, 524 Eighth Avenue, New York.

Scientific Resurrection.

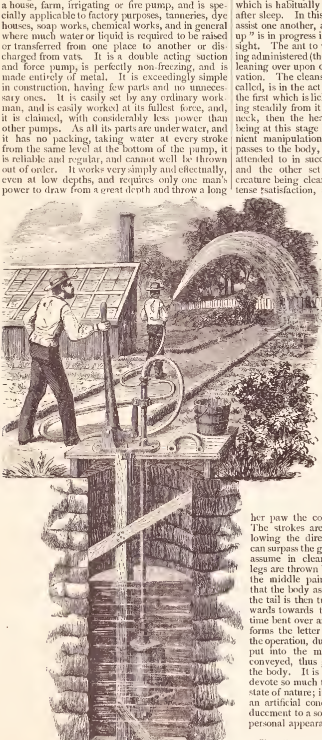
The *London Times* is responsible for the announcement that one Signor Rotura, a gentleman who knows a great deal about South American botany, has found out a method of suspending animation in living bodies for an indefinite time, and of bringing them to life again whenever he likes, unless certain accidental circumstances prevent the success of the experiment in hand. Aided by a Mr. James Grant, Signor Rotura has been operating on dogs, cats and sheep with most marvelous results, if the story is true. He makes a slight puncture in the animal's ear, and pours in a few drops of some South American vegetable extract, now known only to himself, and the dog or sheep immediately becomes rigid, and, to all present intents and purposes, dead. Then the animal is put away on a shelf to keep. Not in this state, however, for long; for it is said that the resemblance to death is so complete that decomposition soon sets in. This, therefore, is to be avoided by freezing the subjects into the hardness of stone and brittleness of glass, and in this state the beasts are to be sent over to England or any other country which may want them. As soon as they arrive another little hole is to be made in the neck, a few drops of the antidote to the poison injected, and the animal will immediately regain consciousness and begin to skip and frolic about. Sometimes, it is said, the subject succumbs to the operation of freezing, but not often. For even such delicate creatures as newly-born lambs have been resuscitated after being apparently dead for 19 days.

The immediate object and application of the discovery is the transmission of the surplus stock of Australian sheep and cattle to Europe; but Signor Rotura expects to work still greater marvels than that. He has not yet experimented upon a human being, because no human being—not even himself—has been found who cared to risk martyrdom in the interests of science; but application is said to have been made to Sir Henry Parkes to allow the next felon condemned to death in the colony to be operated upon. The criminal, probably, would not object. At the worst he could only die, and if the experiment succeeded he would probably receive a pardon for his services. If Signor Rotura gets the man, he proposes to inject the poison, put the felon in a refrigerator for a month, and then take him out and bring him to life again. The most extraordinary part of the story is that the Signor believes that the time the person or animal experimented upon remains unconscious, and this may be years, is not taken out of his ordinary life, because no bodily change will ever take place while the trance lasts, so that a person who was tired of life now and wanted to leave the world and come back another day, would only have to get himself entranced and frozen up, and be brought back to active existence at an appointed time. If all this is invention, it at least shows that the world possesses a writer of romance before whose astounding imagination Baron Munchausen himself must pale his ineffectual fires.

Now, if any of our readers who happen to be of the unfortunate class said to be too far in advance of the age, are unhappy in consequence, and want to live to see the "good times" which are confidently predicted by modern prophets, let them seek Signor Rotura, the gentleman who knows a great deal about South American botany, make their wills, get their ears punctured, enter a durable refrigerator and coolly wait for the consummation of their hopes. Let them make provision in their wills for the periodical replenishment of the ice or other cooling agent, and for the restorative agent to be administered at the proper time through the hole in the neck, "lie down to pleasant dreams," and calmly wait the awakening.

The American Submerged Pump.

THE American submerged pump, represented in the accompanying engraving, is designed for the raising of water from considerable depths and forcing it to any distance required. It is used as a house, farm, irrigating or fire pump, and is specially applicable to factory purposes, tanneries, dye houses, soap works, chemical works, and in general where much water or liquid is required to be raised or transferred from one place to another or discharged from vats. It is a double acting suction and force pump, is perfectly non-freezing, and is made entirely of metal. It is exceedingly simple in construction, having few parts and no unnecessary ones. It is easily set by any ordinary workman, and is easily worked at its fullest force, and, it is claimed, with considerably less power than other pumps. As all its parts are under water, and it has no packing, taking water at every stroke from the same level at the bottom of the pump, it is reliable and regular, and cannot well be thrown out of order. It works very simply and effectually, even at low depths, and requires only one man's power to draw from a great depth and throw a long



distance. All its advantages are positive. It has no negative points. It is claimed to be the cheapest of all the submerged pumps, when its durability is considered, and it costs no more than some others of decidedly inferior workmanship and power. In its entire construction every point has been considered, and, as it stands, the pump is probably as nearly a perfect pump of its kind as human ingenuity can make it. It is manufactured for and sold by Mr. H. H. B. Bloomfield, No. 34 Dey Street, N. Y., whose advertisement appears in our advertising columns. The pump will raise from 12 to 400 gallons per minute, according to size and power applied. Its simplicity and durability are obvious, and we have no hesitation in commending it as ranking among the very best pumps now on the market.

Tidy Ants.

THE agricultural ant of America, writes the Rev. H. C. M'Cook, in the "Proceedings of the Academy of Natural Sciences of Philadelphia," is one of the neatest and tidiest of creatures in her personal habits. Out of the numbers he had imprisoned for observation, he never saw one remain long in an untidy state. When, after some very active work in digging, little particles of earth would adhere to their bodies, these were at once most carefully removed. The whole body, too, is most thoroughly and frequently cleansed, a duty which is habitually attended to after eating and after sleep. In this duty these ants now and then assist one another, and when a general "washing up" is in progress it is an exceedingly interesting sight. The ant to whom the friendly office is being administered (the cleansed, she may be called) is leaning over upon one side as we begin the observation. The cleanser, as the other party may be called, is in the act of lifting the fore leg, which is the first which is licked, the cleanser's mouth passing steadily from it up to the body, then over the neck, then the head, the little jaws (mandibles) being at this stage held apart for the more convenient manipulation; from the face the operation passes to the body, along one side, each leg being attended to in succession; then to the other side and the other set of legs. All this while the creature being cleansed is evincing the most intense satisfaction, and in this resembles a family dog when one is scratching the back of his neck; she rolls gently over on her side, sometimes quite over on her back, and presents altogether a picture of ease. The pleasure which these creatures take in being thus "combed" and "sponged" is really enjoyable to the observer. Several times an ant wanting to be cleaned was seen to approach a comrade, kneel down before it, and thrusting forward its head, then drop down and lie there motionless, expressing, as plainly as sign language could, her desire to be attended to. The ants, when engaged in cleansing their own bodies, have various modes of operating. The fore legs are drawn between the mandibles, and also apparently through the lips, and then are passed alternately to the back of the head and over and down the forehead and face, by a motion which closely resembles that of a cat when cleansing with her paw the corresponding part of her head. The strokes are always made downwards, following the direction of the hairs. Nothing can surpass the grotesque attitude which the ants assume in cleansing their bodies. The hind legs are thrown backwards and well extended, the middle pair stand nearly straight out, so that the body assumes almost an erect position; the tail is then turned under the body and upwards towards the head, which is at the same time bent over and downward. The body thus forms the letter C. The fore feet now begin the operation, during which they are constantly put into the mouth, from which moisture is conveyed, thus giving a glossy appearance to the body. It is possible that these ants do not devote so much time to their toilets when in a state of nature; it is probable that, as with men, an artificial condition of society gives an inducement to a somewhat larger devotion to their personal appearance.

THE SPEED OF TRANSMISSION OF ELECTRIC SIGNALS through submarine cables has been determined experimentally by Professor Hughes, who showed that the time required with his apparatus to produce a signal through different lengths of a submarine cable having a copper conductor 0.064 in. in diameter, No. 16 B.W.G., and an insulating coat 0.069 in. in thickness, were as follows: 75 miles, 0.025 sec.; 150 miles, 0.045 sec.; 225 miles, 0.080 sec.; 300 miles, 0.115 sec.; 375 miles, 0.140 sec; 450 miles, 0.160 sec. Whitehouse found by a series of experiments on the Atlantic cable of 1858, having a conductor composed of a strand of seven copper wires, each 0.028 in. in diameter, and having three coats of gutta-percha of an aggregate thickness of 0.148 in., that the time required to produce a signal upon an ordinary relay was as follows: 145 miles, 0.14 sec.; 247 miles, 0.34 sec.; 494 miles, 0.79 sec.

Bamboo poles, for use as telegraph posts, are being sent to Natal from Madras.

FOR testing dynamite a weighed portion is taken and treated with ether, which dissolves out the nitro glycerine, leaving the inert infusorial earth unaffected. The difference in the two weighings will give the percentage of the explosive present.

Shop and House Hints.

Dainty Dishes.—Delmonico, the prince of caterers, says that Americans ought to copy "the French method of utilizing small bits of raw meats and fowls, and of recooking all kinds of cold joints and pieces of cooked meat which remain, day by day, from every dinner in almost every family." The success of such dishes depends mainly on the sauce, which is best made from broth. The following is his recipe for a favorite sauce: "Take an ounce of ham or bacon, cut it up in small pieces, and fry in hot fat. Add an onion and carrot, cut up, thicken with flour, then add a pint or quart of broth, according to quantity desired, season with pepper and salt, and any spice or herb that is relished (better, though, without the spice), and let simmer for an hour, skim carefully and strain. A wine glass of any wine may be added, if liked." Cold roast or broiled beef or mutton may be cut into small squares, fried brown in butter, and then gently stewed in the sauce above described. Mr. Delmonico describes croquettes as the attractive French substitute for American hash, and tells how to make them: "Veal, mutton, lamb, sweet breads, almost any of the lighter meats, besides cold chicken and turkey, can be most deliciously turned into croquettes. Chop the meat very fine. Chop up an onion, fry it in an ounce of butter, add a tablespoonful of flour. Stir well, and then add the chopped meat and a little broth, salt, pepper, little nutmeg. Stir for two or three minutes, then add the yolks of two eggs, and turn the whole mixture into a dish to cool. When cold mix well together again. Divide up into parts for the croquettes, roll into the desired shape in bread crumbs. Dip in beaten egg, then into bread crumbs again, and fry crisp, a bright golden color. Any of these croquettes may be served plain or with tomato sauce or garniture of vegetables."

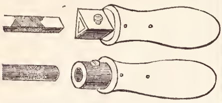
Substitute for Screw Cups in Electric Batteries.—Mr. R. J. Lecky, in the *English Mechanic*, suggests the following connector for ordinary battery purposes, which he finds are easily made and much more handy than the screw couplings generally used; for light wire he uses No. 16, and for heavier Nos. 14

or 12 hard brass wire, which has a good spring in it for holding them together. Twist the wire on to the loop, and fasten with a drop of solder. The sliding action, in connecting them, ensures good contact, and they are readily detached and changed.

Plaster of Paris Casts.—The mixture of plaster and water should not be too thick, but should flow freely, to obtain a good sharp cast. For oiling the mould lard is better than oil, as it adheres better and does not tend to rise to the surface, and it is not so likely to be absorbed by the plaster. Put the lard on with a stiff brush; in order to prevent air bubbles, flood the surface of the mould with water, and let the plaster sink through the water, then pour the water off. Knock the mould on a table or bench; this will force the plaster into every crevice. The water will not hurt the plaster if the work is done quickly. No attempt should be made to remove the cast until it is hard and dry; then if it will not come off easily soak it in boiling water, or heat the metal to which it is attached.

Tempering Mill Picks for Cutting French Burr.—"A Country Miller's" complaint, I am afraid, is only too common with users of cast-steel tools, and the fault lies with the smith—that is, if he uses good steel. Now all smiths know full well that if cast steel is made white-hot it is spoilt; yet if a person takes a chisel, mill-pick or other pointed tool to be repaired, the smith (I am only speaking as a rule) pushes it into the fire. The point is soon white-hot. They will now push it in and out the fire a few times, and at last bring it out red-hot and work it. Of course it is already spoilt; and no matter how low it is tempered, it is next to useless. I should advise "Country Miller" to take one to the smith, and see that he puts the body of the tool in the fire, leaving the two thin ends uncovered till the middle is red-hot. As soon as the middle is red-hot pull back, and let the thin end just get a dull red heat. It must now be hammered edgeways first, and flatways last of all. It is best to hammer it on the flat part of the anvil, as drawing steel on the edge of the anvil, although a great deal quicker, makes it short in the grain, and always causes the tool to break in the thinnest place. Serve the other end the same, only repeat as soon as it loses its dull red color. The lighter the blows in working steel, the tougher it is. The point should be quite as thin as a fitter's chipping chisel, only a little longer, then they will not require doing up so often. When the ends are drawn out the middle will have lost its red heat. The ends can now be filed a little. Now to temper them. Heat them in the flame of the fire, using great care. When a very dull red heat cool in rain-water, with the chill taken off, about ¾ in. from the end, and let down to a blue; if it should be too brittle a little lower. Serve the other end the same. Cool all over. Grind the edge rather blunt, and for the first few blows hit as light as possible. A little soapsuds or oil could be poured on the water, but in my opinion the water is the best. The secret is in working it at as low heat as possible, only keep on repeating very often, and to hit it edgeways as little as possible, but flatways as much as you like.—*English Mechanic.*

New Thing in Files.—A patent for this improvement has been taken in England by a Mr. Gray, of Sheffield. The cut explains itself. The files are made without tangs, and are inserted into holes in



the handles made to fit the files. The files so inserted are held by set-screws. The advantages claimed are reduced cost and greater convenience in use.

Removing Scale from Tea Kettle.—C. D. M. wishes to know how to perform the above. Ans. Boiling potatoes unpeeled in the kettle will, it is said, often effect the detachment of scale. If this does not answer, try boiling water with a lump of common washing soda, and a handful of fresh peeled oak or hemlock bark. Boiling with phosphate of soda for a number of hours may be effective, when the scale is largely composed of sulphate of lime with some magnesia. The loosened scale may be disengaged by gentle rapping with a piece of wood on the outside of the kettle.

Excellent Potato Griddle Cakes.—Boil the potatoes soft, then peel; mash them very fine on the bake-board, knead in flour to the consistence of short paste, with sufficient salt to taste. Roll and bake like oat-cake. When half done on griddle turn and bake the other side.

Scrapers for Brass—These cut freest when held as in Fig. 1, W representing the work, R the

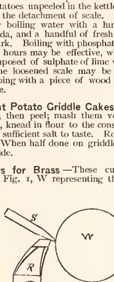


Fig 1.

rest and T the tool; but if under these conditions the

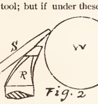


Fig. 2

tool chatters, it may be held as in Fig. 2; or if on

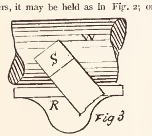


Fig 3

very thin work as in Fig. 3, W representing the work, R the lathe-rest and S the scraper.

Gaskets or Washers for Water Joints.—Perhaps this may be useful to some of the readers of the SCIENTIFIC NEWS who have been troubled with union joints on iron pipe. I tried almost every kind of gasket or washer in a union on hot water apparatus—leather, rubber, lead and other metallic washers—but all gave trouble. At last I hit upon a novel material to many in the plumbing trade, which answered fully, after the others had failed, to give a tight joint—viz.: heavy bookbinders' pasteboard—and I have never had a leaky union joint since.—*Cromro.*

From personal experience we can confirm the value of this material for the purpose named.—EDS. SCI. NEWS.

Oxidized Silver.—What is known as *oxidized silver* is not oxidized silver, but that metal coated in various ways with other metals, or acidulated compounds. Perhaps the best possible effect in "oxidized" silver is produced by brushing over with a very hot solution of the perchloride of platinum. If the solution is applied with a brush, the hair must be fine, or the effect is spoiled, especially if the article is hot. It is a better plan to heat the article when this is practicable, and to dip quickly in the solution; and in certain cases—especially upon fine cut and carved work—it is a good plan to dip also in warm spirit—pure or methylated—and burn off. While speaking of blacks and grays, it may be mentioned that articles of any metal may receive a fine black by simply polishing up with the finest plumbago, and lacquering afterwards, and the prominent portions may be relieved in various ways. If only a gray is required, sulphide of silver in hot solution may be used, or a much weaker solution of platinum chloride than is employed for black. The sulphide of ammonium in hot, weak solution produces a very pleasing dark bronzing. All of these coatings are improved by polishing, after drying, with soft cloth and linseed oil in small quantity; or, if the article is large, wax may be employed with pleasing results, and polished up as with oil; the cloth may require a moistening of turpentine.

BOOK NOTICES.

AMES' ALPHABETS. Adapted to the Use of Architects, Engravers, Engineers, Artists, Sign-Painters, Draughtsmen, etc. By Daniel T. Ames. New York: Bicknell & Comstock, 27 Nassau Street.

This is a fine collection of letter designs, varying from very simple to extremely elaborate. These designs need not be implicitly followed, but are in themselves suggestive of original designs and ornamentation. Full directions for preparing inks, tracing, transferring, etc., are embodied in the work.

THE AMERICAN ANTIQUARIAN is the title of a new quarterly journal, devoted to Early American History, Ethnology and Archæology. Edited by Rev. Stephen D. Peet, Corresponding Secretary or the American Anthropological Association, and of the Archæological Association of Ohio. The periodical is published by Jameson & Morse, Chicago, Illinois.

This publication has reached the fourth number of its first volume, and comes full of matter which must possess intense interest to the devotees of the specialties it represents. The following enumeration of contents will give our readers a better idea of the character of the publication than we can otherwise convey: We name, "The Emblematic Mounds of Wisconsin, by J. N. DeHart, M.D. Shell Beds of Clatsop Beach, by H. B. Clarke. A Comparison between the Archæology of Europe and America, by Rev. S. D. Peet. The Utes of Colorado, by N. C. Meeker. Early Indian Migration in Ohio, by C. C. Baldwin. An Exhibition of Indian Character, by W. L. Coffinbury. Discourse of Dr. Paul Broca, translated by Prof. O. T. Mason. Indian Music, by Rev. M. Eells. Prehistoric Manufacturing Village in the Miami Valley, by S. H. Binkley. Besides the above, there is some attractive correspondence and interesting editorial notes. Those who are interested in subjects of this kind will find the *American Antiquarian* a first-class publication.

Wanted, Platinum Mines.

It is announced that Mr. Edison, having found the present supply of platinum too small to insure the progress and success of his electric lamp, has sent circulars to different mining districts stating the need of the discovery of platinum mines. The circulars give information as to the character of locations where platinum is usually found, the condition in which it generally is obtained, etc., together with specimens of platinum and iridosmine sprinkled upon and attached to cards. We fear this search will prove fruitless. Platinum has long been sufficiently valuable to stimulate search for mines, but as yet few and small quantities have been discovered.

List of Patents Granted June 24th, 1879.

WE will supply copies of any of the patents in this list, post-paid, to any address in the United States or Canada, on receipt of 50 cents per copy.

PATENTS GRANTED JUNE 24th, 1879.

Axle-boxes, die for making, D. Dalzell	216,837
Axle skein and box, vehicle, N. L. Holmes (reissue)	8,766
Bale-ties, device for forming, T. J. Torrans	216,912
Band tightening and tying apparatus, S. H. Gilman	216,844
Beer, fining-shaving for, A. Lachenmeyer	216,868
Belt-fastener, S. Budlong and W. O. Talcott	216,827
Belting, round, F. H. and J. E. Underwood, C. A. Hawkins and G. F. Uhler	216,916
Bit-stock wrench, Q. S. Backus	216,776
Boiler-furnace, W. Scully	216,900
Book, Blank, A. J. Maxwell	216,799
Boot and shoe soles, machine for shaping, J. B. Johnson (reissue)	8,776
Boot and shoe uppers, &c., crimping-machine for, C. Stoddard and J. W. D. Fifield	216,768
Bottle, nursing, S. W. France	216,734
Bottle-washing machine, R. Schulz and E. O. Nagel	216,899
Box, A. Wuensch	216,927
Brick, &c., kiln and shed for burning and drying, W. Mansfield	216,743
Button, S. W. Shorey	216,811
Can filling and soldering apparatus, W. A. Wicks	216,924
Cane-shaving machine, G. S. Colburn	216,723
Car-coupling, H. L. Preston	216,889
Car-coupling, O. Retan	216,891
Carbureting apparatus, air, R. R. Moffatt	216,879
Card-punching machine, Jacquard, G. Crompton and H. Wyman	216,782
Chuck, lathe, J. N. Skinner	216,766
Churn, E. Caldwell	216,780
Churn, H, C, Horsey	216,739
Churn, M. C. Pennock	216,885
Cigar-box, C. Heylmann	216,737
Cigarette-making device, G. H. Backmire	216,817
Clipper and sheep-shearer, horse, E. W. Noyes	216,882
Clutch, friction, T. Powell	216,758
Coal-breaking machinery, W. H. Richmond	216,807
Coat and vest hanger, F. H. Zahn	216,928
Cock, steam-gauge, T. Shaw (reissue)	8,772
Cock, steam-gauge, T. Shaw (reissue)	8,773
Coffee-pot, T. Keys	216,861
Coffin, R. E. McAlister	216,749
Coin-package, O. A. Dennis (reissue)	8,769
Compass, mariner's, J. F. Watson	216,919
Cop-tube, J. Essex	216,839
Copying-presses, blotter-bath for, B. B. Hill	216,738
Cotton-chopper, I. F. Bobo	216,825
Cotton-gin rib, J. A. Smiley	216,903
Cotton-press, J. J. Stopple	216,908
Curtain-cord fastener, E. W. Folsom	216,733
Desk, portable writing, C. C. Shepherd	216,810
Detergent compound, H. A. S. Park	216,805
Disintegrating grain and distilling spirits, apparatus for, E. Fox	216,841
Disks, adjusting cutting, G. S. Colburn	216,724
Doubling and twisting machines, stop-motion for, J. H. Knowles	216,867
Dredging apparatus, J. Grant	216,847
Eclectric light, J. H. Rogers	216,760
Eyeglasses, M. Thum	216,812
Fence-hook, J. and W. M. Brinkerhoff	216,778
Fence, portable, J. Landis	216,742
Fence, potrable, W. G. Poston, W. M. Stevens and W. A. Siders	216,757
Fence-post for wire fences, iron, J. W. Jackman	216,855
Fence-twister, metallic, J. and W. M. Brinkerhoff	216,779
Fire-arm, magazine, S. T. Harrison	216,848
Fire-extinguishing apparatus, G. Barnes	216,821
Fog-signal, W. B. Barker	216,820
Fruit-can, W. Collings	216,831
Furnaces, dumping dead-plate for, N. W. Pratt	216,888
Galvanic battery, W. S. Wilson	216,774
Gate, T. D. Crumpton	216,726
Gate, J. S. Noyes	216,883
Glue-stock, trea ing bones for, W. Adamson	216,816
Governor, Dynamometrical, E. A. Bourry	216,826
Governor, engine, S. Whinery	216,922
Grain separator, J. N. Clees (reissue)	8,775
Grain-separators, bl st-regulator for, C. H. Faling	216,732
Grate, fire, R. MacKellar	216,872
Grate, fire-p'ace, J. B. Tarver	216,769
Grinding-mill, A. Stevenson and S. Wylde	216,906
Harness-mountings, constructing, S. S. Sargent	216,764
Harness-strap, T. G. Glennon	216,845
Harrow, smoothing, C. A. Meeker	216,878
Harrow, wheel, J. S. Corbin (reissue)	8,765
Harvester, J. P. Manny	216,744
Harvester, J. P. Manny	216,745
Harvester, J. P. Manny	216,746
Harvester guard-finger, J. P. Manny	216,748
Harvester-mitt, A. Gillinn	216,788
Hay-press, E. E. Fuller	216,785
Hay-rake, horse, S. H. Bushnell	216,829
Hedge-trimmer, A. G. Rogers and H. M. Freeman	216,894
Hedge-trimmer, H. Unkrich	216,915
Hinge, spring, W. G. Barry	216,777
Hoe, T. B. Lockwood (reissue)	8,777
Hoisting device, D. Abrey	216,815
Holdback, vehicle, T. W. and H. K. Porter	216,756
Horse and mule shoes, machine for making, J. A. Burden	216,828
Horses to vehicles, apparatus for attaching, J. Knights	216,741
Hose-coupling, O. B. Hall, 2d	216,736
Hose-coupling, W. F. Hofmann	216,851
Hydrocarbon-burner, S. C. Salisbury	216,898
Hydrocarbon-burning apparatus, R. F. Humiston	216,853
Ink-powders, capsuled, G. J. Collins	216,832
Iron, dephosphorizing, S. G. Thomas	216,910
Jail, prison and grating bar, G. Kinsey and H. P. McDonald	216,865
Lamp-shade holder, H. D. Stanley	216,905
Lamps, manufacturing glasses for street and other, W. P. Butler	216,830
Lasting-machine, J. S. Shailer and M. R. Ethridge	216,765
Latch, C. H. Smith	216,904
Locomotive-boiler cleaner, W. Titcomb	216,911
Lounge, folding, J. E. Binder	216,718
Metal tubes, machine for reducing the diameter of, S. P. M. Tasker (reissue)	8,774
Milker, mechanical cow, A. A. Durand	216,838
Millstone-driver, W. J. Blackwell	216,824
Mortising-machine, E. H. N. Clarkson	216,722
Motion by impact, combined lever rotary, H. B. Keiper	216,794
Mower, W. R. Otis	216,754
Nailing-macbine, L. Goddu	216,790
Night-chair, C. Kienzle	216,863
Nut-lock, C. G. Lea	216,870
Oil-can-shipping case, E. Morgan, Jr	216,751
Ore-separator, H. W. King	216,740
Organ, reed, G. W. Scribner (reissue)	8,771
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Oven, portable, W. F. Rossman	216,896
Paint or covering, roofing, J. R. Hazelet	216,850
Paper bag, C. Newman	216,881
Paper-clips, machine for setting eyelet, W. A. Rollins	216,895
Paper-machines, dandy-roller for, W. S. Tyler	216,914
Paper, package of prepared, C. C. White	216,923
Pegging-machine, gang, E. Woodward and M. Brock	216,926
Piston meter, steam, J. A. Cook	216,833
Pitman-connection, J. P. Manny	216,747
Plant sprinkler, A. Schrader	216,808
Planter, check-row corn, J. H. Allyn	216,775
Planter, combined, R. I. Cowden	216,781
Planter, corn, J. A. Patterson	216,755
Plastering walls, machine for, G. Stevens	216,907
Plow, E. Wiard	216,772
Plow, E. Wiard	216,773
Polishing-machine, L. A. Sanford	216,763
Potato-digger, C. F. Benz	216,822
Printing-machine, oscillating, G. W. Prouty	216,890
Propeller, chain, T. L. Lee	216,871
Propeller, enameled screw, H. Nelson	216,880
Pump, G. W. McKenzie	216,877
Pump for testing-machines, hydraulic, T. Olsen	216,752
Rail-tie and joint, L. A. Gouch	216,846
Railway-gate, L. C. Pope and O. N. Tincher	216,886
Railway-rails, piling old, J. Griffen and M. P. Weeks (reissue)	8,770
Railway-switch, D. Tracy	216,913
Refrigerating air for cooling beer and other liquids, apparatus for, F. Pallausch	216,884

Refrigerating-chambers, condenser for, F. Roloson. 216,761
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Rolling-mill, A. Mechwart ... 216,750
Rowlock, G. W. McKenzie ... 216,876
Safe-doors, device for opening, C. F. Gessert ... 216,843
Sash and bead fastener, window, L. Fisher ... 216,784
Sash-cord guide, F. B. Sloan and F. S. Clarkson ... 216,767
Sash-fastener, G. F. Knight ... 216,866
Saw-handle, adjustable, W. McNiece ... 216,800
Saw-mill dog, C. H. Roberts ... 216,893
Screw-cutting tap, B. Stott ... 216,909
Sectional boiler, N. W. Pratt ... 216,887
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Steamer, food, S. H. Baker ... 216,717
Steering apparatus, S. G. Martin ... 216,873
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Tag, P. F. King ... 216,796
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Telegraph, railway-car, E. J. J. De Baillehache ... 216,716
Telephone, electric, J. H. Irwin ... 216,793
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Time-locks, automatic winding mechanism for, S. M. Lillie ... 216,797
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Water-wheel, turbine, F. M. Kent ... 216,860
Whiffletree-hook, W. L. B. and J. J. Cushing ... 216,727
Wire, spool for winding, E. M. Crandal ... 216,836

Business Hints.

Fifty Cents per Line, in advance, will be Charged for all Business and Personal Notices admitted into this Column. Cuts cannot be admitted.